THE · EXTENSION PATHOLOGIST

A NEWS LETTER FOR EXTENSION WORKERS INTERESTED IN PLANT DISEASE CONTROL

SERIAL NO. 47 March 1942

VEGETABLE SEED TREATMENTS

Now when American farmers and canners are bending every effort to produce the necessary fresh and canned vegetables called for in the Food-for-Freedom Program, every practice that will help them to their goals should receive attention. The treatment of vegetable seed helps to control diseases, to insure stands of healthy plants, to conserve seed supplies and labor, and to increase yields.

We present herewith a report on results of a series of widespread cooperative tests that aid greatly in formulating recommendations on vegetable seed treatment. The following table shows recommendations for seed protection and damping-off control for beet, cabbage, cucumber, lettuce, peas, and spinach based on results given in this report:

Crop	Treatment	Rate percent by weight	Cost of material for treating 100 pounds of seed (dollars)
Beet	Red copper oxide	1.5	.56 - 1.35
	or		
	Semesan	2.5	2.97 - 6.25
Cabbage	Hot water*	-	--
	and		
	Semesan	0.4	.83 - 1.05
	or		
	Zinc oxide	2	.20 - 1.00
Cucumber	Red copper oxide	0.25	.09 - .23
	or		
	Semesan	0.31	.66 - .83
Lettuce	Red copper oxide	2	.77 - 1.80
	or		
	Zinc oxide	2	.32 - 1.00
	or		
	Semesan	0.2	.41 - .51
Peas	Spergon	0.2	.62 per acre**
	or		
	Semesan	0.3	1.49 per acre**
	or		
	Red copper oxide	0.25	.24**
Spinach	Zinc oxide	2	.20 - 1.00
	or		
	Red copper oxide	2	.75 - 1.80

* Disinfection treatment for black-leg and black-rot control; soak seed in water at 122° F. for 25 minutes.

** At the rate of 4 bushels of seed an acre.

SUMMARY OF RESULTS FROM COOPERATIVE SEED TREATMENT TESTS WITH BEETS, CABBAGE, CELERY, CUCUMBERS, LETTUCE, PEAS, SPINACH, AND SWEET CORN IN 1941

Prepared from the original reports
of committee members
By Harold T. Cook

INTRODUCTION

The cooperative tests conducted by the Committee for Coordination in Seed Treatment Research of the American Phytopathological Society through its subcommittee on vegetable seed treatments* assume considerable importance in the present national emergency. The results obtained are helping to solve the problem of reducing losses from diseases, seed decay, and damping-off. This reduction is very important now that certain seed stocks may become limited and there is need to make effective use of every pound of fungicide and fertilizer and every hour of labor. Seed treatments that destroy seed-borne pathogens reduce the chances of crop failure and, in some crops, eliminate or simplify the problem of field spraying. Treatments that prevent seed decay and damping-off reduce the amount of seed required per acre both by eliminating the need for replanting and by permitting a reduction in seeding rate in some crops.

The 1941 tests had the same general objective as those of 1940: To determine the relative merits of the more promising fungicidal seed treatments under widely different conditions and to devise suitable methods of research for securing more reliable information on the applicability of the different treatments. The 1940 tests determined the relative effectiveness of red copper oxide, zinc oxide, and hydroxymercurichlorophenol on beet, cabbage, cucumber, pea, spinach, and tomato seed. All these crops responded significantly to one or more of the treatments in a large proportion of the tests with the exception of tomatoes, which were significantly benefited in only five out of 27 tests.

In view of results obtained in the 1940 tests and suggestions made at the conference in Philadelphia, the committee did not include tomatoes in the 1941 tests. They modified the treatments for beets, cabbage, cucumbers, peas, and spinach; and added celery, lettuce, and sweet corn to the program. Treatments used in 1941 are indicated in the section on each crop.

The policy of the committee has been to include in the tests only seed-treatment materials whose chemical composition is known and, preferably, only those materials whose chemical composition is indicated on the package label. This is important, since the results obtained apply only to the specific material used in these tests and would not apply to another material that may at some later date be marketed under the same trade name. Chemicals used for treating seed in this year's tests are indicated in table 1.

* Members subcommittee: H. T. Cook, chairman, C. M. Haenseler, L. D. Leach, and G. L. McNew. J. C. Walker aided the committee materially by supervising the tests with cucumbers and peas, and T. J. Nugent rendered valuable assistance to the chairman by helping in the preparation of data sheets and directions for statistical analysis.

Table 1.--Chemicals Used in Cooperative Seed Tests

Chemical	Trade Name	Product of
Zinc oxide	AAZ Special	Rohm and Haas Co.
Zinc oxide	Vasco 4	Virginia Smelting Co.
Red copper oxide	Cuprocide	Rohm and Haas Co.
30% hydroxymercurichlorophenol	Semesan	Bayer-Semesan Co.
1% ethyl mercury phosphate	Semesan, Jr.	Bayer-Semesan Co.
2% ethyl mercury chloride	2% Ceresan	Bayer-Semesan Co.
Tetrachloro-para-benzoquinone, or chloranil	Spergon	U. S. Rubber Co.

Tests in 1941 were conducted in 31 experiment stations in 25 States and 2 provinces of Canada. The localities were represented by the following cooperators who made these tests possible: L. D. Leach, California; J. G. Horsfall and A. D. McDonnell, Connecticut; John Johnston and Leroy Parker, Delaware; W. B. Tisdale, Florida; Walter J. Virgin, Idaho; H. H. Thornberry, Illinois; J. H. Standen, W. N. Rice, and A. W. Welch, Iowa; S. P. J. Chilton, Louisiana; Donald Folsom, Mrs. I. M. Burgess, R. M. Bailey, and Reiner Bonde, Maine; Carroll E. Cox, Maryland; O. C. Boyd and C. J. Gilgut, Massachusetts; J. H. Muncie, Michigan; Carl J. Eide, Minnesota; C. M. Haenseler, New Jersey; H. S. Cunningham, New York (Riverhead, L.I.); Orson S. Cannon, New York (Nassau County): George L. McNew, New York (Geneva); Don E. Ellis, North Carolina; J. D. Wilson, Ohio; K. S. Chester, Oklahoma; W. S. Beach, Pennsylvania; Frank L. Howard, Rhode Island; C. N. Clayton, South Carolina (Charleston); C. J. Nusbaum, South Carolina (Edisto): G. H. Godfrey, Texas (Weslaco); A. L. Harrison, Texas (Yoakum); T. J. Nugent, Virginia; J. G. Leach, West Virginia; J. C. Walker, Wisconsin; Irene Mounce, Canada (British Columbia); G. A. Scott, Canada (Ontario).

One or more tests with each crop were conducted at each of the localities, as indicated in table 2. The total number of tests conducted for each crop varied from 12 to 33. This number of tests conducted over a wide area of the country and analyzed by uniform methods affords a much more reliable basis on which to judge the relative value of the seed treatments for the country as a whole than do smaller-scale tests conducted independently in a few States.

The cooperators had a somewhat larger share in running the tests and analyzing the data than they had in 1940. Enough seed of each treatment for five replications of 100 seed each were sent to the cooperators in bulk, and the cooperator counted out the seed for each replication. Also the cooperators, with a few exceptions, analyzed their own data. Analysis forms and directions for the tests with each crop were furnished the cooperators to insure that all data would be analyzed by the same method.

Data from the tests with all the crops were analyzed by Fisher's method for analysis of variance of a simple randomized block experiment. Data from the tests with beets, cabbage, and spinach were also analyzed as complex experiments. The average seedling stand for each treatment in each test was given in the report distributed at the seed-treatment conference held at Dallas, Tex, from December 29, 1941, through January 2, 1942 but in this condensed report the data have been summarized. A few of the original reports are still available for those who are interested in the more detailed data. (Note corrections of such report, page 12.)

Table 2.--Location and number of tests conducted with each crop of vegetables

State	Crop							
	Beets	Cabbage	Celery	Cucumber	Lettuce	Peas	Spinach	Corn
California	2		2	2	1	2	1	
Connecticut	2				1	2	1	2
Delaware		1		1		1		1
Florida		1		1	1			
Idaho						1		
Illinois	1	1		1	1	1	1	1
Iowa	1			1	1	1	1	1
Louisiana		2						
Maine					1	1	1	2
Maryland		1		2		1		1
Massachusetts		1	1	1	1			1
Michigan	1	1		1		1	1	1
Minnesota	1	1	1	1	1		1	1
New Jersey	2	2	1	2	1	2	2	2
New York (G.)	2	3	1	1	1	1	1	1
New York (L.I.)	1	1		1	1	1	1	1
New York (N.C.)	1					1	1	
North Carolina		1		1	1	1	1	1
Ohio	1			1		1		1
Oklahoma	1			1	1	1	1	1
Pennsylvania			1			1	1	
Rhode Island	1	1	1	1	1	1	1	1
South Carolina (C)	1			1		1	1	1
South Carolina (E)		1		1	1	1	1	1
Texas (W)	1					1	1	1
Texas (Y)	1			1		1	1	
Virginia	2	2	2	1	1	1	2	1
West Virginia		1		1		1	1	1
Wisconsin	1	1	1	1		4	1	
Canada (B.C.)	1	1				1		
Canada (O)	1	1	1	1	1	1	1	1
Total	25	24	12	26	17	33	25	25

Note.--Key to abbreviations: L.I. = Long Island; N.C. = Nassau County; G. = Geneva; C = Charleston; E. = Edisto; W = Weslaco; Y = Yoakum; B.C. = British Columbia; O = Ontario.

BEETS

The beet-seed-treatment tests were conducted under the supervision of Dr. G. L. McNew of the New York Agricultural Experiment Station at Geneva, N. Y. Twenty-five tests were conducted at 20 stations in 15 States and 2 Canadian Provinces.

Seed of the variety Detroit Dark Red were used for these tests. Three fungicides - red copper oxide, zinc oxide, and Semesan - were compared as dust treatments at three different dosages. The red copper oxide and zinc oxide were used at dosages of 1.5, 3.0, and 6.0 percent, and the Semesan was used at dosages of 0.62, 1.25, and 2.5 percent.

In 21 of the 25 tests, most of the treated seed gave better seedling stands than did the untreated seed, and in 16 of the tests the data were statistically significant. The data showed clearly that red copper oxide was most effective at the lowest dosage used, and Semesan and zinc oxide were most effective at the highest dosage. Relative values of treatments as indicated by the total number of times each treatment was significantly better than some other treatment are given in table 3.

Table 3.--Relative values of dust treatments of beet seed

Treatment	Dosage (percent)						
	0	0.62	1.25	1.50	2.50	3.00	6.00
Red copper oxide				49		29	30
Zinc oxide				21		23	39
Semesan		29	36		53		
Check (untreated)	0						

Red copper oxide showed a tendency to cause injury in dry, sandy, acid soil, whereas Semesan caused injury in two tests in which the seed were planted in neutral or alkaline soil. No injury was noted from zinc oxide. About equally good results would be obtained from red copper oxide at 1.5 percent and from Semesan at 2.5 percent. Zinc oxide even at 6 percent was considerably inferior to the other two fungicides. The cost of treating 100 pounds of beet seed with the optimum dosage of Semesan varies from $2.97 to $6.25, depending on the quantity of fungicide purchased; the cost of treating with red copper oxide at the optimum dosage is only 56 cents to $1.35.

The 1941 tests confirm in general the results obtained in the 1940 tests in that they show that red copper oxide and Semesan are better than zinc oxide for treating beet seeds. In addition, they show that relatively heavy dosages of Semesan are necessary for maximum benefits, but that excellent results are obtained with a light dosage of red copper oxide. These tests also indicated that beet seed respond well to treatment and that seed treatment is a worth-while practice with this crop.

CABBAGE

The cabbage-seed treatment tests were also conducted under the supervision of Dr. McNew. Twenty-four tests were conducted at 19 Stations located in 16 States and 2 Canadian Provinces.

Seed of the variety Marion Market were used in these tests. The object was to determine the effect of dust treatments with Semesan and zinc oxide on the emergence of seed that had previously been treated with hot water, and on untreated seed. The seed was divided into two lots, one of which was soaked in hot water at 122° F. for 25 minutes; the other lot was left untreated. Each lot was then divided into three lots, one of which was dusted with Semesan at a dosage of 0.42 percent, one with zinc oxide (Vasco 4) at a dosage of 2 percent, and the remaining lot left undusted.

In 22 of the 24 tests the chemically treated seeds produced better stands than unprotected seeds and in the same number of tests the hot-water treated seeds produced fewer plants than the seeds that had not been disinfected with hot water. The data were statistically significant in 17 of the tests.

The relative values of the treatments as indicated by the total number of times each treatment was significantly better than some other treatment are given in table 4.

Table 4.--Comparative values of treatments

Chemical treatment	Hot water treated	Not hot water treated
Semesan	9	47
Zinc oxide	8	41
Untreated	0	15

It will be noted that the dusted seed are better than the untreated seed; Semesan is slightly better than zinc oxide; and hot-water treated seeds are not so good as seeds treated with hot water.

No information was obtained from these tests in regard to the effectiveness of the hot-water seed treatment in the control of disease. This treatment, however, has been recognized for a number of years to be very effective for eliminating the blackleg and black-rot organisms from infected seed. The general use of the hot-water seed treatment has been retarded by the risk of serious reduction in germination of the seed. Tests show that hot-water treated seed that is dusted with either zinc oxide or Semesan will produce as many plants as undusted seed that has not been treate with hot water. The dust treatments give enough protection to counterbalance the weakening of the seed that results from the hot-water treatment. This comparison is illustrated in table 5, in which the average number of seedlings for the 17 statistically significant plots is given.

Table 5.--Germination results of tests

Chemical treatment	Hot-water treated	Not hot-water treated
Semesan	60.22	69.99
Zinc oxide	58.45	67.96
Check (untreated)	50.32	59.33

It will be noted in table 5 that the dusted seed not treated with hot water produced more plants than the corresponding lots of seed that had been treated with hot water. The use of the dust treatments alone would not be desirable, however, since they are not sufficiently effective against either the blackleg or black rot organisms.

The cost of treating 100 pounds of cabbage seed with Semesan at the dosage used in these tests varies from 83 cents to $1.05 depending on the quantities in which the fungicide is purchased. The cost of treating with zinc oxide varies from 20 cents to $1. Difference in cost of materials for treating the usual quantities of cabbage seed would be little.

CELERY

The celery seed treatment tests were conducted under the supervision of Dr. L. D. Leach of the California Agricultural Experiment Station. Twelve tests were conducted at 10 stations in 9 States and 1 Canadian Province.

Seed of the 1940 crop of Dwarf Golden Plume celery was used for these tests. The object of the tests was to determine whether or not the usual protective seed treatments are worth while for celery. The seed were therefore divided into 4 lots and treated with red copper oxide and zinc oxide at dosages of 2 percent, and with Semesan at a dosage of 0.2 percent. The fourth lot was left as an untreated check.

The outstanding feature of the celery tests was the fact that the data for 10 of the 12 tests were not statistically significant. Not one of the treatments was significantly better than the checks in the remaining two tests. There was some indication of injury from the red copper oxide and Semesan treatments. The results from these tests indicate that celery seed is not benefitted by treatment with the materials used. A larger number of tests, however, may have given other results; or, treatment with some other materials may be beneficial.

CUCUMBER

The cucumber seed treatment tests were conducted under the supervision of Dr. J. C. Walker of the Wisconsin Agricultural Experiment Station. Twenty-six tests were conducted at 23 stations in 19 States and 1 Canadian Province.

Seed of the Chicago Pickling variety were used for these tests. The seed were divided into three lots. One lot was treated with red copper oxide at the rate of 0.6 ounces to 15 pounds of seed, another lot was treated with Semesan at the rate of .75 ounces to 15 pounds of seed, and the third lot was left as an untreated check.

The data for 11 of the 26 tests were statistically significant. The relative values of the treatments as indicated by the total number of times a treatment was significantly better than some other treatment are red copper oxide 18, Semesan 16, and check 0. These results confirm those obtained in 1940 in that they indicate that red copper oxide and Semesan are about equally effective as seed protectants for cucumber. The cost of treating 100 pounds of cucumber seed with red copper oxide varies from about 9 cents to 23 cents depending on the quantity of fungicide purchased; and the cost of treating with Semesan varies from 66 cents to 83 cents. Red copper oxide would therefore be the more economical for treating cucumber seed.

LETTUCE

The lettuce seed treatment tests were conducted under the supervision of Dr. C. M. Haenseler of the New Jersey Agricultural Experiment Station. Seventeen tests were conducted at 17 stations in 15 States and 1 Canadian Province.

Seed of the variety New York Special #12 were used for these tests. The seed were divided into four lots. Red copper oxide at the rate of 2 percent was applied to the first lot, zinc oxide was applied to the second lot at the same rate, Semesan was applied to the third lot at the rate of 1/2 ounce to 15 pounds of seed, and the fourth lot was left untreated.

The data were statistically significant in only 7 of the 17 tests. The relative values of the treatments as indicated by the total number of times a treatment was significantly better than some other treatment were red copper oxide 13, zinc oxide 9, Semesan 4, and check 0. The average seedling stands for the treatments in the 7 statistically significant plots were red copper oxide 70.1, zinc oxide 66.3, Semesan 59.4, and check 46.8 The results obtained in these tests indicate that lettuce seed responds best to treatment with red copper oxide followed by zinc oxide and Semesan. All the treatments caused better seedling stands than were obtained from the untreated seed. Since statistically significant data were obtained in only 7 of the 17 tests, lettuce seed does not appear to respond so well to these protective seed treatments. The cost of treating 100 pounds of lettuce seed is from 77 cents to $1.80 for red copper oxide, 32 cents to $1 for zinc oxide, and 41 cents to 51 cents for Semesan, depending on the quantities in which the fungicide is purchased.

PEAS

The pea-seed treatment tests were conducted under the supervision of Dr. J. C. Walker of the Wisconsin Agricultural Experiment Station. Thirty-three tests were conducted at 27 stations in 21 States and 2 Canadian Provinces.

Three varieties of peas of different type were used in order to see how they would react to the treatments:

1. Alaska - an early starchy-cotyledon variety used widely for canning and for dry peas.

2. Surprise (Wisconsin Early Sweet) - an early sugary-cotyledon variety used widely for canning.

3. Thomas Laxton - midseason, large-seeded, sugary-cotyledon variety used widely for frozen pack and for home and market garden.

Each variety was divided into five lots, and the following treatments were applied:

1. Red copper oxide - 0.6 ounces to 15 pounds of seed.

2. Semesan - 0.75 ounce to 15 pounds of seed.

3. 2% Ceresan - 0.5 ounce to 15 pounds of seed.

4. Spergon - 0.5 ounce to 15 pounds of seed.

5. Untreated.

The varieties differed in their vulnerability to seed decay and in their response to seed treatment. The Alaska or starchy type proved less vulnerable to seed decay and was benefited less by the seed treatments than the sugary type as represented by the Surprise and Thomas Laxton varieties. Of the latter varieties, the Surprise was most susceptible to seed decay and was benefited most by the seed treatment. All three varieties germinated between 80 and 90 percent in the laboratory test, but in the 33 field tests, the average emergence from the untreated was 79 percent for the Alaska variety, 55 percent for the Surprise, and 60 percent for Thomas Laxton. The data were statistically significant in only 10 of the tests with the Alaska variety, but were significant in 25 of the tests with Surprise and 23 of the tests with Thomas Laxton.

The relative value of the different treatments was similar for all three varieties. Spergon and Semesan were about equally matched for first place, red copper oxide was next, and Ceresan was the least beneficial. All the treatments produced more plants than the untreated seed.

The cost of materials for an acre when seeded at the rate of 4 bushels an acre would be $1.49 for Semesan, 62 cents for Spergon, 26 cents for Ceresan, and 24 cents for red copper oxide. Considering the cost of materials and the effectiveness of the treatments, the choice of fungicides would probably lie between red copper oxide and Spergon. In a considerable number of tests the increase in stand with Spergon was enough greater than that obtained from red copper oxide to more than make up the differential in costs. Spergon also has the advantage of not requiring the addition of graphite to eliminate friction.

SPINACH

The spinach-seed treatment tests were conducted under the supervision of Dr. H. T. Cook of the Virginia Truck Experiment Station at Norfolk, Va. Twenty-five tests were conducted at 23 stations in 18 States and 1 Canadian Province.

Seed of the Virginia Savoy variety were used in these tests. Two fungicides - red copper oxide and zinc oxide - were tested at dosages of 0.5, 1, 2, and 4 percent. An untreated check was also included for comparison.

The data from 18 of the 25 tests were statistically significant. The relative values of the different treatments as indicated by the total number of times each treatment was significantly better than some other treatment are given in table 6.

Table 6.--Relative value of spinach seed treatment tests

Chemical	Dosage			
	0.5%	1%	2%	4%
Red copper oxide	18	17	27	25
Zinc oxide	26	35	33	41
Check (untreated) 1				

These data indicate that for equal dosages the zinc oxide was somewhat superior to the red copper oxide treatment. The differences in actual stand of seedlings although significant are probably not of economic importance, so for practical purposes the materials may be considered about equally effective.

The data in table 6 indicate that maximum benefits with red copper oxide are obtained with a dosage of 2 percent; with zinc oxide 4 percent. However, excellent results also were obtained with zinc oxide at 1 and 2 percent, and for practical purposes these dosages are probably best since it is difficult to make 4 percent stick well to the seed.

The cost of treating 100 pounds of spinach seed with a 2 percent dosage is 75 cents to $1.80 for red copper oxide and 20 cents to $1 for zinc oxide, depending on the quantities in which the fungicide is purchased. Although red copper oxide and zinc oxide may be considered equally effective, the difference in cost makes the latter the preferred treatment.

SWEET CORN

The sweet-corn seed treatment tests were conducted under the supervision of Dr. C. M. Haenseler of the New Jersey Agricultural Experiment Station. Twenty-five tests were conducted at 22 stations in 19 States and 1 Canadian Province.

Seed of the Golden Bantam variety were used in these tests. The seed were divided into four lots. One lot was treated with red copper oxide at the rate of 2 percent, another lot with zinc oxide (Vasco 4) at the same rate, and the third lot with Semesan Jr. at the rate of 1-1/2 ounce, to a bushel of seed. The fourth lot was left untreated.

The data in 16 of the 25 tests were statistically significant. In 14 of these tests red copper oxide caused a significant reduction in stand. Zinc oxide was better than the check in only 2 tests, and Semesan Jr. was better than the check in only 3 tests. Apparently neither the zinc oxide nor the Semesan Jr. was effective in increasing the stand; and red copper oxide was injurious at the dosage used.

CONCLUSIONS

Beets respond well to protective seed treatments, and seed treatment may be recommended as a general practice. Red copper oxide used at the rate of 1.5 percent is the most economical and effective of the treatments tested. Equally good results may be obtained with Semesan used at the rate of 2.5 percent, but the cost of treating with this material is much greater.

Hot-water seed treatment may cause considerable reduction in germination of even good quality seed. Treating cabbage seed with Semesan at the rate of 0.42 percent or with zinc oxide at the rate of 2 percent increases the number of plants produced, whether the seed has been treated previously with hot water or not. Hot water treated seed that has been dusted with either Semesan or zinc oxide produces as many plants as undusted seed that has not been treated with hot water. Treatment with hot water is a necessary practice in order to avoid seed-borne black leg or black rot. Dusting the seed with Semesan or zinc oxide counterbalances the weakness of the seed that has been caused by the hot-water treatment.

Celery seed did not respond to treatment with red copper oxide, zinc oxide, or Semesan.

Cucumber seed were benefited by seed treatment in a fair proportion of the tests. Red copper oxide and Semesan are about equally good for treating cucumber seed, but red copper oxide is the more economical to use.

Lettuce seed were benefited by seed treatment in a fair proportion of the tests. Red copper oxide used at the rate of 2 percent was the best treatment tried, zinc oxide used at the same rate was second best, and Semesan used at the rate of 1/2 ounce to 15 pounds was third. All treatments produced more plants than the untreated seed.

The Alaska variety of peas representing the starchy-cotyledon type was injured less by seed decay than were the Surprise and Thomas Laxton varieties which represented the sugary-cotyledon type. The Alaska variety responded the least to the seed treatments; the Surprise responded most, followed closely by the Thomas Laxton. Spergon and Semesan were about equally good, and the best of the seed treatments that were tested. Red copper oxide was also a very beneficial seed treatment. Spergon is much lower in cost than Semesan, and has the advantage over red copper oxide of being more effective and not requiring the addition of graphite to reduce friction.

Spinach responded well to seed treatment. Zinc oxide and red copper oxide were found to be about equally effective, but zinc oxide has the advantage of being much lower in cost. A 2-percent dosage was the optimum for both materials.

No increases in stand were obtained with any of the treatments tested on sweet corn, but red copper oxide at a 2-percent dosage was injurious.

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CORRECTION OF DATA IN ORIGINAL REPORTS DISTRIBUTED AT DALLAS, TEX.

The following corrections should be made in the data given in the original reports on cucumbers and spinach. In cucumber test No. 17 the average number of seedlings for red copper oxide should read 63.6 and the average number for Semesan should read 72.4. The calculated value of "F" should be 13.96.

In spinach test No. 25, the average number of seedlings for the check in table 2 should read 31.4; the difference required for significance should be 14.7, and the calculated value of "F" should be 2.67.

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